ORIGINAL ARTICLE

PREVALENCE OF MUSCULOSKELETAL PROBLEMS AND AWKWARD POSTURE IN A PAKISTANI GARMENTS MANUFACTURING INDUSTRY

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ABSTRACT

This cross-sectional study aimed to serve as a pilot investigation to identify the level of discomfort and awkward posture among the workers of a garments manufacturing industry. The study was conducted for both male (54) and female (26) workers working in two different departments - stitching and finishing. Data were collected using both questionnaire and direct observation. As discomfort cannot be measured directly, a questionnaire was used to measure it based on subjective ratings by the workers. For analyzing posture, two objective assessment tools were used – rapid upper limb assessment (RULA) to analyze sitting posture and rapid entire body assessment (REBA) for standing posture. The cumulative scores of discomfort for different body parts were measured. The lower back was found to be at the highest risk as compared to other body parts. Female workers had higher score of discomfort (mean = 2.9615, S.D. = 1.3931) as compared to their male counterparts (mean = 1.2693, S.D. = 0.6538). Similarly, standing workers suffered more discomfort (mean = 2.7272, S.D. = 1.3090) as compared to sitting workers (mean = 1.0909, S.D. = 0.3784). No worker received ergonomically acceptable score for both of postural assessment tools. The mean RULA score was 5.25 and mean REBA score was 5. The results of this study necessitate a company-wide ergonomic assessment immediately.

Keywords*: Discomfort, posture, garments manufacturing, musculoskeletal disorders, RULA, REBA*

INTRODUCTION

Garments manufacturing industry is highly labor-intensive especially in developing countries like Pakistan. Most of the times, these labors have to work in adverse conditions. The working generally consists of long hours with one lunch break in the middle of the day. These workers are rarely provided with appropriate workstations and weak social infrastructure adds to the risk of discomfort and illness. But such risks are rarely investigated at workplace. Little work has been done to investigate the risk of disorders in garments manufacturing as compared to other areas of work[1,2]. A study of ergonomic risk factors for female Turkish sewing operators showed high posture scores (RULA score of 6.9) and risk of musculoskeletal disorders[3]. About two-third of the operators had suffered from one or more musculoskeletal disorders during the last six months.

The present study was conducted in a plant of one of the largest garments manufacturers in Pakistan. The industry had a well-established department for “safety” issues, but little attention was formally paid to “health” problems at workplace. This study was conducted to act as a pilot project to give initial picture for what was planned to be an industry-wide ergonomic assessment program.

The goal was to investigate major ergonomic risk factors that could ultimately result in occupational illness. The results of this pilot study were planned to be critically analyzed and act as initial evidence for a complete ergonomic assessment. It was aimed to find the areas that need further attention and to assist in introducing preventive measures and developing guidelines with regard to friendly working practices.

The term musculoskeletal disorders (MSD) are used to refer to injuries and illnesses of different body structures involved in movement. The symptoms usually include pain and discomfort in body parts including upper limbs, back and lower limbs – upper limbs and back have been reported to suffer more[4]. There are a variety of terms used to refer to these disorders - in the USA, cumulative trauma disorders (CTD); in Japan, occupational cervicobrachial disorders (OCD); and in Australia, repetitive strain injuries (RSI) is used to describe them. In recent days a new term occupational overuse syndrome (OOS) is also used[5]. Whatever the term used to describe them, these disorders are the major cause of illness and injuries at workplace[6].

The working posture of the workers in the case industry was not proper. The seated workers had to sit day long on a stool without a back support. Also, the standing workers were trying to balance their day long activity by supporting on one leg only. A number of MSDs could occur across these workers. Some example postures are shown in Figure 1.

METHODS

This cross-sectional study was conducted in a garments manufacturing factory that manufactures and exports denim jeans. Fabric is received in the cutting department in rolls, is cut in the desired patterns, and then sent to sewing machine operators. Pieces sewn are sent to the washing department where they are dried. The dried pieces are sent to finishing department where a number of tasks are performed. The final product (denim jeans) are delivered to final ironers to be pressed and made ready for sale after inspection by final inspectors. The manufacturing continues on an 8-hour/day based shift system.

The sample comprised 80 workers having at least one year's experience working in the industry. As there were both male and female workers (more males than females) it was assured that both were represented in the sample – 54 male and 26 female workers participated in the study. The workers selected were from two departments – 47 from stitching and 33 from finishing department. These were the departments with a large number of complaints of discomfort, stress, and awkward postures. There were a total of about 300 workers in both departments. In this study, data were collected using both questionnaire and direct observation of the study participants. Discomfort survey questionnaire by Industrial Accident Prevention Association (IAPA) was used for this study[7]. The workers were asked to indicate if they had experienced discomfort, fatigue, or pain during the last 12 months. The 4-point scale was used. On average, one questionnaire had taken 10 to 15 minutes to be filled. The summary of scores is shown in Table 1.

Rapid upper-limb assessment (RULA)[8,9] is used to assess the risk of musculoskeletal disorders for tasks in which upper limbs are predominantly used. This tool has been used and validated by a number of practitioners and researchers and is particularly applicable to sedentary tasks[3,10]. RULA provides a single score, ranging from 1 (lowest) to 7 (highest) to indicate the risk of musculoskeletal disorders based on posture, force and movement. The final score can be converted into one of the four action levels. These action levels indicate the time frame to initiate the change to reduce or eliminate the risk[8,9]. The working postures were evaluated using RULA for seated workers - no employees had a score of 1-2 i.e. acceptable posture. Mean RULA score was 5.2, as shown in Table 2. This score indicates that work posture needs to be immediately investigated and changes in posture are required soon.

(a) (b) (c)

Figure1 – Example postures of workers: (a), (b) seated; (c) standing

Table 1 – Summary of discomfort for different body parts (n = 80)

Body Parts	Mean	SD	Body Parts	Mean	SD
Neck	2.03	1.03	Shoulder	2.33	1.10
Elbow	1.48	0.72	Upper Back	2.27	1.09
Forearms	1.73	0.95	Lower Back	2.36	1.10
Wrist/Hands	1.85	1.02	Hips	1.21	0.57
Thighs	1.78	1.11	Knees	1.60	0.80
Ankles/Feet	2.23	1.24	Lower Legs	1.84	1.02

Table 2 - RULA score for female (n = 26) and male (n = 54) workers

RULA	Score A		Score B		Grand Score		
	Mean	SD	Mean	SD	Mean	SD	Range
Female	3.8	0.91	3.9	1.19	5.4	1.07	4-6
Male	3.5	0.84	3.7	1.05	5.1	1.10	4-6
Combined	3.6	0.87	3.8	1.10	5.2	1.07	4-6

Score A includes the upper limb, lower limb and wrist scores. Score B includes neck, trunk, and legs scores. The grand score is obtained by adding posture scores to the muscle use and force scores. The action level categories for different RULA scores are shown in Table 3.

Table 3 - Action level categories of RULA[8]

Range	Description	Range	Description
1-2	Acceptable posture	5-6	Further investigation, change soon
3-4	Further investigation, change may be needed	7	Investigate and implement change

Rapid entire body assessment (REBA)[11,12] is used to assess the working postures that are unpredictable. It is an easy-to-use tool to analyze postures involving whole body that can cause risk of musculoskeletal disorders. REBA has been validated in a number of studies and is specifically applicable to situations involving standing postures[11,13]. In the present study no employees received REBA score of 1-2 i.e. acceptable posture. Mean REBA score was 5, as shown in Table 4. This score indicates that work postures need to be investigated without delay and changes in postures are required soon.

Table 4 - REBA score for female (n = 26) and male (n = 54) workers

REBA	Score A		Score B		Score C		Grand Score		
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Range
Female	4.1	1.16	3	1.09	4.1	1.16	5.1	1.16	4-7
Male	3.8	1.34	2.7	0.95	3.8	1.57	4.8	1.57	4-7
Combined	4	1.22	2.8	0.98	4	1.35	5	1.35	4-7

Score A is found by adding the sores of neck, trunk, and legs with load/force score. Score B is found by adding the upper arms, lower arms, and wrists scores with coupling score. Score C is obtained from table using score A and B. The grand score is obtained by adding muscle activity score. The action categories against final score of REBA are shown in Table 5.

Table 5 - Action level categories of REBA[11,13]

Range	Description	Range	Description
1	Negligible risk	8-10	High risk, investigate and implement change
2-3	Low risk, change may be needed	11+	Very high risk, implement change
4-7	Medium risk, further investigation, change soon		

RESULTS

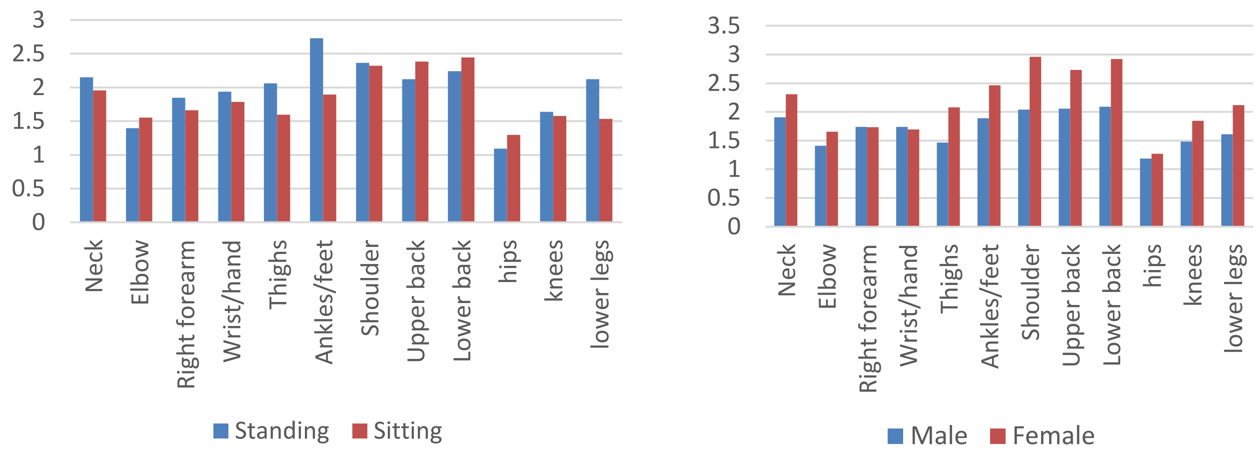
Statistical analyses of the data were performed in Minitab V. 16. The difference in discomfort score between male and female workers was found to be statistically significant ($p < 0.05$), as shown in Table 6. This shows that, although overall working conditions are poor, female workers are more at risk. Further investigations should be made to validate this gender-specifity of ergonomic risk in the industry. The difference between discomfort of seated and standing workers was not significant ($p > 0.05$), as shown in Table 7. The comparison between discomfort score of standing and seated workers, as well as male and female workers is shown in Figure 2.

Table 6 - Statistical results of comparison between discomfort of male and female workers

Two-sample T for Male Discomfort vs. Female Discomfort				
	N	**Mean**	**SD**	**SE Mean**
Male Disc.	54	22.24	7.17	0.98
Female Disc.	26	28.73	9.10	1.8
95% CI for difference:	(-10.60, -2.38)			
T-Test of difference =	0 (vs. not =): T-Value = -3.19 P-Value = 0.003 DF = 40			

Table 7 - Statistical results of comparison between discomfort of seated and standing workers

Two-sample T for Sitting Discomfort vs. Standing Discomfort				
	N	**Mean**	**SD**	**SE Mean**
Sit. Disc.	47	23.62	8.27	1.2
Stand. Disc.	33	25.39	8.54	1.5
95% CI for difference:	(-5.60, 2.04)			
T-Test of difference =	0 (vs. not =): T-Value = -0.93 P-Value = 0.356 DF = 67			



(a) (b)

Figure2 - Discomfort score comparison between (a) standing & seated workers, (b) male & female workers

The number of years at job was divided into two groups. Group A: workers with work experience of up-to 5 years. Group B: workers with work experience of more than 5 years. The difference in discomfort based on working experience was not found to be significant (p > 0.05), as shown in Table 8.

Table 8 - Statistical results of comparison between discomfort based on number of years at job

Two-sample T for Discomfort for< 5 Years vs. Discomfort for > 5 Years				
	N	**Mean**	**SD**	**SE Mean**
Discm. < 5 Yrs	57	24.07	8.73	1.2
Discm. > 5 Yrs	23	25.70	7.61	1.6
95% CI for difference:	(-5.58, 2.33)			
T-Test of difference =	0 (vs. not =): T-Value = -0.83 P-Value = 0.412 DF = 46			

DISCUSSION

The present study was one of the first attempts to evaluate the working conditions from ergonomics point of view in the case garments manufacturing industry. The discomfort was found to be high among the study population. The frequency of symptoms was significantly higher in females; especially the mean severity of shoulder, low back, and upper back symptoms was higher in females than in males. Also these symptoms were more severe in standing workers than sitting workers, although the difference was not significant.

Sitting uses less energy and helps to stabilize the body. Standing workstation fixes a person's posture which can compromise their wrist posture, thereby increasing risks of injury such as carpal tunnel syndrome. Standing also increases pressure on cartilage in the knees, hips, and balls of the feet; requiring 20% more energy than sitting; as a result placing greater strain on the circulatory system[4,14,15]. For standing workers alternate sit stand workstation is more appropriate as it balances the day long activity. As the workers in stitching department were maintaining a seated posture for the whole day, a chair with a lumbar support should be provided for these workers. As this was first study of this kind in the sample industry, further investigation is required to validate the results. However, it is apparent that the workstations are poorly designed and some macro-level improvements are immediately required. These may include providing lumbar-support for seated workers, as already stated, and modifying the nature of task for standing workers; for example redesigning the task as sit-stand. The female workers are more prone to ergonomic risks as compared to their male co-workers, and their tasks need an immediate intervention.

This study focused mainly on the discomfort in different body parts and the level of risk of posture. There are other factors that could also be considered to have more complete picture of ergonomic risk factors. For example, the lighting level, the frequency and duration of rest breaks monotony of the tasks etc. Lighting is particularly important for the visually demanding tasks, like inspection. Most of the workers have to work continuously on the same tasks. Appropriate rest breaks are therefore mandatory. Repeatedly performing the same task also creates a feeling of monotony that could affect the job performance. Therefore, these aspects should also be investigated in future studies to get broader perspective of situation in the industry.

CONCLUSION

This study showed a high level of discomfort in different parts of body for the workers. Shoulders, upper back, and lower back suffered the most. Also, the posture was found to be very risky. These factors could result in cumulative trauma disorders (CTDs) in the long run. Unfortunately, there are no statistics available for Pakistan on the absenteeism or number of lost days because of these problems. However, these measures are likely to be high; especially with low standards of health care services in the country.

Although the workers are at risk as a whole in the company, the females are more at risk. This finding is important as the garment sector in the country employs a large number of female workers. Such females generally have a dual role to play: earn their livelihood and take care of their family members, especially their kids – the latter role being ignored in most of the studies. Therefore, providing these females with suitable and healthy working environment can have both organizational and social impacts, although the latter cannot be measured directly.

The standing workers had higher scores of discomfort and posture. The management was recommended to change their task as sit-stand task. If possible, such workers should be provided short breaks more frequently instead of one long break. It will help their tissues recover quickly and improve their productivity. In order to get a more complete picture of the hazards, future studies must consider other ergonomic factors as well.

ABBREVIATIONS

RULA-Rapid upper limb assessment, REBA-Rapid entire body assessment, MSD-Musculoskeletal disorders, SD-Standard deviation.

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COMPETING INTERESTS
There is no conflict of interest.

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